REMARKS

Claims 1-40 are pending in the application. Claims 29 and 33-40 have been canceled without prejudice in view of the Finality of the Restriction requirement. Applicants gratefully acknowledge the Examiner's indication that claim 20 includes allowable subject matter and would be allowable is rewritten as suggested. Reconsideration of the rejections and objections is requested.

Drawing Objections

The drawings were objected to for the reasons set forth on pages 2-3 of the Office Action. Applicants respectfully traverse the drawing objections. 37 CFR 1.81(a) states, essentially, that a drawing should be provided where necessary for the understanding of the subject matter sought to be patented. What this means is that a drawing is not needed in circumstances where the clamed invention is understood without the drawing.

Here, the subject matter that is purportedly missing from the drawings relates to the subject matter of claim 20, which Examiner has indicated includes allowable subject matter. In this regard, it appears that the Examiner understands the claimed subject matter without resort to specific illustration and, in fact, makes no assertion that the claimed invention is not understandable.

Indeed, the subject matter of claim 20 is clearly explained in detail on page 30, line 15 ~ page 31, line 4, which is sufficient for one of ordinary skill in the art to understand the invention. In view of the above, Applicants respectfully contend that illustration of the subject matter of claim 20 in a drawing is not necessary for an understanding and use of the invention by a person of ordinary skill in the art. However, if the Examiner still believes that a drawing is necessary, Applicants may consider adding

a figure to show such subject matter upon Examiner's request. In the meantime, withdrawal of the drawing objections is respectfully requested.

Claim Rejections - 35 U.S.C. §102

(A) Claims 1-7, 10, 19, 22, 24, 26 and 27 are rejected as being anticipated by U.S. Patent No. 4,649,990 to Kurihara. Applicants respectfully traverse the rejection and contend that at the very minimum, the subject matters of claims 1, 22 and 26 are patentably distinct and patentable over Kurihara.

For instance, with regard to claim 1, Kurihara clearly does not disclose or suggest, e.g., *a thermal joint formed between the non-active surface of the semiconductor chip and the mating surface of the heat conducting device, the thermal joint comprising a plurality of interdigitated thermal fins separated by a compliant thermally conductive material, wherein the interdigitated thermal fins comprise the first and second thermal fins, and wherein a gap size between the interdigitated thermal fins of the thermal joint varies across the thermal joint*, as recited in claim 1.

The Examiner contends on page 4 of the Office Action that Kurihara discloses in FIG. 1 a thermal joint comprising a plurality of interdigitated thermal fins (20, 16a) separated by a compliant thermally conductive material (21). Kurihara teaches that a spring element (21) is arranged in a space formed between the protrusion (16a) and the opening (20a) of a heat-conducting relay member (20) disposed on a backside of a chip (10), wherein the spring (21) maintains the heat-conducting relay member (20) in contact with the chip (10) (see, Col. 8, lines 20-24). Kurihara also teaches that the gaps between

the heat conducting relay members (20) and housing (16) is filled with helium gas to form a heat conducting path by the gas (see, Col. 8, lines 45-49).

In this respect, in the context of the claimed inventions, it is respectfully asserted that the Examiner's characterization of the spring element (21) as being a *compliant thermally conductive material* that separates a plurality of interdigitated thermal fins (20, 16a) is a glaringly strained interpretation for various reasons. First of all, Kurihara does not teach or remotely suggest that the spring element (21) is provided for heat conduction purposes, rather Kurihara teaches the helium gas (which is not a compliant material) which fills the gaps provides the heat conducting path between the surfaces of the elements 16 and 20 (see, e.g., Col. 8, line 50~63, Col. 9, lines 59-67).

Moreover, Kurihara teaches that the opening (20a) of the heat-conducting relay member (20) forms a small gap (30) relative to the sidewall of the protrusion (16a) of the housing (16) and that the length L of overlap and gap distance between the side wall (20c) of element (20) and the sidewall (16b) of protrusion (16a) are primarily determinative of the thermal resistance in the thermal interface (Col. 8, lines 29-31; Col. 10, lines 18-42; FIG. 2)). In this regard, the Examiner's characterization of the element (20) as being a "thermal fin" is seemingly strained as the protrusions (20c) from the bottom (20b) of the element (20) may be more accurately characterized as "thermal fins" In this regard, such "thermal fins" (20c) and (16a) are not separated by the spring element (21) (i.e., the spring element is not between the thermal fins as is contemplated by the claimed inventions), but rather the helium gas (19) is disposed between the thermal fins (16a) and (20c) (in FIG. 2).

Furthermore, there is no teaching in Kurihara of *a gap size between the interdigitated thermal fins of the thermal joint that varies across the thermal joint,* as claimed in claim 1. Clearly, Kurihara teaches that for each chip (10), the gaps between the "thermal fins" (20c) and (16a) are the same for each chip (10) and across all chips (10) (as illustrated in FIGs. 1 and 2). Moreover, the Examiner's finding in this regard is not supported, nor can it be supported, by any explicit teaching of Kurihara with respect to varied gap sizes.

Furthermore, the teachings of Kurihara are equally deficient to support the anticipation rejection of claim 22. Kurihara, for example, does not disclose or suggest *wherein each thermal joint comprises a plurality of longitudinally extending interdigitated thermal fins separated by a compliant thermally conductive material*, as recited in claim 22, for at least the same reasons explained above with respect to claim 1.

Furthermore, Kurihara clearly does not disclose or remotely suggest that *the longitudinally extending interdigitated thermal fins of each thermal joint formed between the semiconductor chips and heat conducting device are orientated to extend in a direction that passes through a neutral stress point of the semiconductor package*, as recited in claim 22. The Examiner contends that this claimed subject matter is disclosed because "the fins pass over the entire chip, and therefore all points of the chip" (see, page 4 of the Office Action). It is respectfully submitted that this finding is simply irrelevant and misses the point.

FIG. 1 of Kurihara discloses a plurality of chips (10) wherein the "thermal fins" formed over each chip extend in the same direction. In this regard, the "thermal fins" for each chip (10) do not, and cannot, extend in a direction that passes through a neutral

stress point of the semiconductor package, because at least two or more chips (10) would have to have their associated 'thermal fins" extending in different directions, which is not illustrated in FIG. 1 of Kurihara, much less supportable by citation to any portion in the specification of Kurihara.

Furthermore, the teachings of Kurihara are equally deficient to support the anticipation rejection of claim 26. For instance, Kurihara does not disclose or suggest a *thermal joint comprising a band of interdigitated thermal fins comprising first and second thermal fins mated together and thermally coupled using a rigid bonding material or a compliant thermally conductive material*, as essentially claimed in claim 26, for at least those reasons explained above.

Moreover, Kurihara does not teach or suggest *the thermal joint further comprises a complaint thermal conductive material formed between planar portions of the non-active surface of the semiconductor chip and the mating surface of the heat conducting device.* The Examiner characterizes the element (16) in FIG. 1 of Kurihara as the "heat conducting device". However, in view of FIG. 1, there is no reasonable basis to conclude, nor does the Examiner even aver, that a portion of the thermal joint is formed by compliant thermal conductive material formed between a planar portion of a non-active surface of chip (10) and the mating surface of the heat conducting device (16) In fact, the interdigitated fins (16a) and (20c) for each chip (10) are shown in FIG. 1 as being disposed across the entire chip (10). In this regard, there are no planar portions of the backsides of the chips (10) that are thermally coupled to the heat conducting device (16) via a compliant thermal conductive material, as contemplated by the claimed inventions.

Accordingly, for at least the above reasons, claims 1, 22 and 26 are clearly patentably distinct and patentable over Kurihara. Moreover, claims 2-7, 10, 19, 24 and 27 are patentable over Kurihara for at least the same reasons given for respective base claims 1, 22 or 26.

(B) Claims 1, 10, 21-28, and 30-32 are rejected as being anticipated by U.S. Patent No. 5,052,481 to Horvath. Applicants respectfully traverse the rejection and contend that at the very minimum, the subject matters of claims 1, 22 and 26 are patentably distinct and patentable over Horvath.

With regard to claim 1, although Horvath arguably teaches (in FIG. 3A) a thermal joint comprising a plurality of interdigitated thermal fins separated by a compliant thermally conductive material (e.g., fins 42, 43of cooling hat (40) are intermeshed with fins 17, 18 of finned internal thermal devices (14), where the gaps between adjacent rigid fins of cooling hat (40) and finned internal device (14) are filled with a compliant thermal medium (29)), Horvath does not disclose that *the gap size between the interdigitated thermal fins of the thermal joint varies across the thermal joint.* For example, Horvath discloses an exemplary embodiment where the width of the oil filled gap between corresponding fins is the same (see, e.g., Col. 15, lines 47-50). The Examiner asserts that Horvath teaches "varied gap sizes" but does not support this assertion with specific teachings by Horvath, except by general citation to FIG. 3A and 7. However, the Examiner's reliance on FIGs. 3A and 7 as disclosing varied gap sizes is at the very least unclear, if not wholly misplaced.

Moreover, the Examiner has not shown how Horvath teaches *the longitudinally extending interdigitated thermal fins of each thermal joint formed between the*

semiconductor chips and heat conducting device are orientated to extend in a direction that passes through a neutral stress point of the semiconductor package, as recited in claim 22. Again, the Examiner contends that this claimed subject matter is disclosed because "the fins pass over the entire chip, and therefore all points of the chip" (see, page 6 of the Office Action). It is respectfully submitted that this finding is simply irrelevant and misses the point for at least the same reasons explained above. The Examiner has not shown how this feature is met. In fact, FIG. 2 of Horvath illustrates a plurality of chips (11) mounted on a substrate (10), wherein a cooling hat (40) has continuous channel formed therein providing thermal fins that extend in the same direction over the entire cooling hat (40). In this regard, the "thermal fins" for all chips (11) would extend in the same direction, and thus, the thermal joints of every chip would not have thermal fins extending in a direction that passes through a neutral stress point of the semiconductor package.

Furthermore, with regard to claim 26, the Examiner has not explained, much less asserted, that Horvath teaches *the thermal joint further comprises a complaint thermal conductive material formed between planar portions of the non-active surface of the semiconductor chip and the mating surface of the heat conducting device.* In fact, given the Examiner's finding (on page 6 of the Office Action) that Horvath teaches that *the fins pass over the entire chips, and therefore all points of the chip,* the Examiner cannot consistently argue that another portion of the thermal joint (where the interdigitated thermal fins are not formed) is formed by a planar portion of the non-active surface of the chip and mating surface of the heat conducting device separated by compliant thermal conductive material.

Accordingly, for at least the above reasons, claims 1, 22 and 26 are patentable over Horvath. Moreover, claims 10, 21, 23-25, 28 and 30-32 are patentable over Horvath for at least the same reasons given for respective base claims 1, 22 or 26.

Claim Rejections - 35 U.S.C. §103

Claims 15-18 are rejected as being unpatentable over U.S. Patent No. 4,649,990 to Horvath. (although this rejection appears to be based on Kurihara). This rejection is legally deficient on its face at least insofar as Kurihara fails to disclose or suggest the elements of claim 1 from which claims 15-18 depend.

Claims 11-14 are rejected as being unpatentable over Horvath '481. This rejection is legally deficient on its face at least insofar as Horvath ' 481 fails to disclose or suggest the elements of claim 1 from which claims 11-14 depend.

Claims 8 and 9 are rejected as being unpatentable over Horvath '481 in view of U.S. Patent Application Publication 2003/0150635. Again, this rejection is legally deficient on its face at least insofar as Horvath ' 481 fails to disclose or suggest the elements of claim 1 from which claims 8 and 9 depend.

Accordingly, withdrawal of the obviousness rejections is requested.

Respectfully submitted,

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